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THE ESTIMATION OF MEAN DRY BULB TEMPERATURE DURING DAYLIGHT HOURS

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Introduction

A request for mean day-time temperature by months for several places provided the opportunity to examine formulae for deriving this parameter from readily available data on average mean daily maximum and average mean daily minimum temperatures for individual months.

Brooks (1959, p.180) quotes Went (unpublished) for the expression: the "effective" day-time temperature = mean daily maximum $-\frac{1}{4}$ (the daily range) or conveniently,

$$\overline{T}\ (\text{day}) = \overline{X} - \tfrac{1}{4}\ (\overline{X} - \overline{N})$$

$\overline{N}$ being the mean daily minimum. This expression, being derived for USA conditions, cannot necessarily be assumed valid for other climatic regions.

Smith (1957) gives values of the factor month by month for Aberdeen and Kew ranging from 0.30 to 0.43. (N.B. Smith states that he is concerned with a proportion of the "mean diurnal range" - it is thought that this should probably read "mean daily range", i.e. the difference between mean daily maximum and mean daily minimum as used by Went and was adopted in this present note. These are the values which are generally published in climatological summaries.)

Mean monthly values for period 1957-66 of hour by hour dry bulb temperatures were readily available for Edinburgh (Turnhouse) and London (London Airport), together with estimates (based on observations for each 3 hours) for Paris (St Maur) for period 1951-60, form the basic material for the computations.

Method and Analysis

(1) Data

London: Mean hourly dry bulb temperatures (month by month) for 1957 to 1966 (Metform 3257).

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Mean daily maximum and minimum temperatures for 1957 to 1966 (Metform 3259).

Turnhouse: Mean hourly dry bulb temperatures (month by month) for 1957 to 1966 (Metform 3257).

Mean daily maximum and minimum temperatures for 1957 to 1966 (Metform 3259).

Paris: Estimates of mean hourly dry bulb temperatures based on 3-hourly observations for 1957 to 1960 (Service Météorologique Metropolitain).

Mean daily maximum and minimum temperatures (MO 617c).

Day lengths for the 15 day of each month were taken from the Nautical Almanac.

(2) Procedures

A mean temperature quoted for a particular hour (hh) was regarded as the mean value for the period (hh - 30 min) to (hh + 30 min). Temperatures for incomplete 60 minutes at sunrise and sunset were weighted according to the convention:

≤ 15 min:	0 x hourly value
> 16 to ≤ 45 min:	$\frac{1}{2}$ x hourly value
> 45 min:	1 x hourly value

Values for the factor a_ϕ were ~~completed~~ computed from the equation:

$$\overline{T}\ (\text{day}) = \overline{X} - a_\phi\ (\overline{X} - \overline{N})$$

The magnitude of a_ϕ was noted to be rather sensitive to decision as to the weightings attached to incomplete hours: accordingly smoothed values for Edinburgh, London and Paris were obtained, using the graduation formula $\frac{1}{4}\ (a + 2b + c)$.

(3) Results

These are set out below

Table 1. Proportion of mean daily range to be subtracted from mean daily maximum to obtain a mean day-time temperature

Month / Author or Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Brooks	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
Smith (Kew)	.33	.34	.35	.35	.37	.41	.39	.39	.35	.33	.32	.30
Smith (Aberdeen)	.35	.35	.34	.36	.39	.43	.40	.39	.35	.29	.30	.36
Edinburgh (Turnhouse)	.34	.35	.38	.39	.41	.45	.42	.40	.37	.35	.36	.34
London (Heathrow)	.36	.39	.39	.40	.42	.46	.43	.41	.42	.36	.39	.32
Paris (St Maur)	.21	.23	.29	.28	.25	.25	.22	.25	.27	.25	.25	.20

Clearly there are two groups represented respectively by results for the British Isles on the one hand and those for France (Paris) and USA on the other. In this second group the factors show little or no seasonal variation about an average of 0.25; in the first we have higher absolute values and a seasonal maximum in summer.

It was noted the unsmoothed monthly values for the British Isles followed more irregular sequence after, as compared with before, the summer peak.

References

Brooks F A (1959) An introduction to Physical Microclimatology. Univ Calif Davis, California

Smith L P (1957) Unpublished Papers in the Meteorological Office (Agr Memo No 16).